An Ocean Model for De-aliasing High-Frequency Barotropic Sea Level Variations

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Abstract

Recent studies reveal the significance of high frequency (T < 20days) sea level fluctuations associated with a barotropic response of the ocean to wind and atmospheric pressure variations. These sea level variations pose an aliasing problem for altimetry (e.g., TOPEX/POSEIDON, Jason-1) and gravity missions (e.g., GRACE). This study aims to establish an operational model to estimate the wind- and pressure-driven high frequency signals and to remove them from satellite measurements, similar to the treatment of tidal aliasing. A shallow-water, barotropic model, forced by wind and pressure estimates from NCEP, is tuned with respect to TOPEX/POSEIDON data and ocean bottom pressure observations by way of adjustments to model friction and bottom topography. Globally averaged, the wind- and pressure-driven models explain dynamic signals of 2.7 and 0.2 cm^2 in the sea level and 2.0 and 0.5 $mbar^2$ in the bottom pressure variations, respectively. The nature of the ocean's response is investigated by analyses of the model and data. In particular, a global non-inverted barometer response is revealed due to a 5-day Rossby-Haurwitz wave in atmospheric pressure.